REMARKS

Introduction

Applicants acknowledge the extensive work done by the examiner in bringing forth new and apparently more relevant art, as well as the examiner's extensive analysis thereof in view of the claims. The examiner's action necessitated applicants' extensive review of the currently presented claims and amendments to some of the claims either to clarify the claimed inventions or to define over the art. Applicants also present a number of new claims to more thoroughly and better define the subject matter that they regard as their invention.

To place in perspective the nature of the claimed features, applicants make general comments about the cited art and the subject matter of the inventions claimed, or claimed recitals thereof.

Currently, applicants claim (i) a range measuring device, (ii) a communication system, (iii) a method of detecting an object, (iv) a waveform adaptive UWB transmitter, (v) a method of a one-pulse, one-bit UWB transceiver, (vi) a method of communicating data by transmitting and receiving a UWB pulse, and (vii) a method of transmitting a UWB pulse. Considering the alleged teachings of the cited art, distinctive features vary among corresponding claim groups.

In the official action at hand, the examiner's comments supporting the various rejections seemly intermingle or confuse purported low-level *timing* signals of the prior art references with low level *UWB signals* recited in the claims. Certain of the claims, as explained below, define over the art by reciting a "low-level" UWB signal. This feature is important because much of the art relied upon by the examiner, particularly those references relating to radar or object detection, uses a trigger or pulse firing circuit to produce and radiate a *high-level* UWB signal. As known in UWB transmitters, it is desirable to provide a pulse of rather high peak power level and of very short duration, i.e., in the nanosecond or sub-nanosecond range. Such "high-level" signals are not generally suitable for pre-processing prior to radiating, such as by filtering, attenuating, amplitude modulation, phase/frequency shifting, or waveform adapting. Filtering or waveform adapting a ***high level*** signal, for example, tends undesirably to smooth rather than sharpen the pulse, reduce peak

power levels, or reduce rise time. Thus, during reconsideration, applicants believe care should be taken not to confuse low-level *timing signals* with the recited low-level *UWB signals* (or low-level *RF pulse bursts*) that are actually radiated. In the currently amended claims, applicants have attempted to clarify recitals directed to low-level UWB signals or pulse bursts to assist the examiner in properly analyzing distinctions over the art.

Previously, the examiner as well as applicants have attempted to define "filter" or "filtering" in a way to better define over the cited art. To the extent this feature is important, certain of the claims now recite a "wave filter" or "wave filtering" in order to clarify or distinguish from the broad definition of the term ascribed by the examiner.[1] Fullerton '927 is the only cited reference that purportedly discusses filtering of a UWB signal at the output of a UWB pulse generator. Such filtering was mentioned only in passing as Fullerton provides no real disclosure or realization of such a filter or how it is to be implemented. As explained below, use of a UWB filter with monocycle pulses seems inconsistent since, according to Fullerton, UWB signals require intentional radiation over all frequency bands. Moreover, Fullerton '927 does not teach a "wave filter" or an "out-of-band" rejection filter, as recited in some of the amended claims. Based on Fullerton '927's disclosure as a whole, however, his disclosure seems to allude only to a filter providing varying center-frequencies in a band having a required width of 1GHz or more.

It is also noted that the *type* of UWB signal provided by applicants' claims may be a distinguishing factor relative to the cited art. Fullerton '927 (Fig. 2A), for example, utilizes "monocycle" pulses whereas, in certain of applicants' claims, the UWB signal comprises an RF burst that have a few cycles, as shown by applicants' Fig. 5(d). Because a single monocycle pulse has no periodicity between pulses, it inherently lacks a carrier and may not respond well to traditional types of modulation, filtering, or waveform adapting. In fact, Fullerton '927 provides that such monocycle pulses may only be modulated by PPM, but not by other means. UWB energy bursts of the type recited in certain of applicants' claims, as explained below, comprise a few cycles of RF energy having a carrier frequency defined by the periodicity between cycles. The UWB burst is generated, in certain of the claims, by an impulse-driven oscillator and is more suitable for waveform adapting prior to being radiated.

[1] Applicants' original specification supports a "wave filter" at page 21, line 2; page 16, line 30; and page 21, lines 26-26.

Fullerton's monocycle pulses might also be converted to UWB signal bursts to achieve advantages of applicants' invention, but this is not shown in or suggested by Fullerton '927.

In newly added claims, applicants have drawn their invention, among other things, to a method in a one-pulse, one-bit UWB transceiver system. This distinguishes over systems like Fullerton '927 that integrate 200 or more pulses to demodulate a single information bit. Such method also distinguishes over systems like McEwan '600, which simultaneously detect and compare transmitted and received microwave signal bursts rather than measuring a time-of-flight between pulses to measure object distance. The "low-level" recital of newly added claim 50-57 also distinguishes over Fullerton '927 since his monocycle pulse at output stage 1028 is not "low-level," but instead, is inherently "high-level" due to its one-cycle duration.

In newly added claim 29, support for the one-pulse, one-bit UWB transceiver is provided at page 32, line 18 of the specification. Bandpass filtering to reject out-of-band emissions is shown at page 19, line 21; page 20, line 11; and page 25, lines 27-28 of the specification.

In claims 33-34, coherency and non-coherency is supported at page 30, lines 1-8 of the specification.

In claim 35, impulse driving an oscillator is shown at page 25, lines 22-25.

In claim 36, impulse-driving a mixer is shown at page 18, line 20.

In claim 37, impulse-driving a mixer with a low voltage to attain switching at hundreds of megabits per second is shown at page 19, lines 14-19.

In claim 39, amplitude modulating by on-off switching is shown at page 18, line 21; page 19, lines 11; and page 25, line 22.

In claim 40, multi-level amplitude modulating is shown at page 20, lines 5-6 and page 25, line 30.

In claim 41, phase-shifting is shown at page 20, line 2.

In claim 43, frequency hopping is shown at page 26, lines 15-17,

In claim 47, gating an amplifier with occurrences of low-level UWB pulses is shown at page 22, lines 11-12; page 23, lines 27-31; and page 27, lines 4-13.

In claim 48, the short duration range of sub-nanoseconds to a few nanoseconds is shown at page 23, lines 26-27.

In claims 50 and 56, transmitting and receiving a pulse is shown at page 32, line 18. Also in claims 50 and 56, filtering the energy burst to reject out-of-band emissions is shown at page 19, line 21; page 20, line 11; and page 25, lines 27-28.

Claim Objection

By the current amendment, applicants correct the language of claims 25-28 to recite "reflected pulse" instead of an "echo" to attain consistency in recitals throughout the claims.

Claim Rejection Under 35 U.S.C. §112, Second Paragraph

The examiner contends that the phrase "said impulse generator" recited in line 7 of claim 2 is not clear, suggesting an inconsistency with the earlier recited "switched impulse generator" (line 4) or the "UWB impulse generator" (line 5). In reply, the generator of line 7 has been amended to "switched impulse generator" to remove the asserted ambiguity. In addition, the limitation "switched impulse generator" as used in claim 2 has been further characterized, as explained below.

Claim Rejection Under 35 U.S.C. §102(e) (McEwan '600)

The examiner rejected claims 2 and 3 under §102(e) as being fully anticipated by McEwan '600, suggesting that "each and every element" as set forth in these claims is found in a single reference, or that "the identical invention" is fully shown by the single reference. MPEP, §2131. In reply, applicants believe the examiner mistakenly compared certain parts of the disclosure of McEwan '600 with elements recited in the claims.

First, McEwan '600 describes a range measuring device, not a communication system as recited in claim 2. Thus, a rejection under §102 of the Title 35 is inappropriate.

Second, at page 4 of his comments, the examiner contends the recited "switched impulse generator" of claims 2 and 3 is shown by elements 16, 15, and 12 of McEwan's Fig. 1. After studying the reference, it is seen that McEwan's oscillator 10 (element 100 (Fig. 5) and element 200 (Fig. 6)) uses an RF signal generated by an inductor 126 or 254 to bias the oscillator 10 in an ON state, and uses a QUENCH signal of a lower frequency oscillator to quench the output of oscillator 10. In the amendatory language of claim 2, applicants have

clarified the "switched impulse generator" by further characterizing it as one of "an on-off switched oscillator, an oscillator having a time-gated dc bias, and an impulse-gated mixer that mixes an oscillator output." As currently amended, none of these limitations is shown or suggested by McEwan '600.

Third, claim 3, on the other hand, recites "impulse-switching an oscillator to generate a low-level ultra-wideband signal." This step also differs from the RF ON biasing shown by McEwan '600.

Fourth, the examiner states that elements 17 and 10 (Fig. 1) of McEwan '600 show the recited "filter" or "filtering" of claims 2 and 3. In amended claim 3, however, applicants further defined these terms as "filtering" or a "wave filter[2]" to further distinguish over McEwan '600. This is intended to address the broad interpretation the examiner previously ascribed to the term "filter" or "filtering" at page 14 of his comments. Clearly, McEwan '600 does not teach or suggest a wave filter.[3]

Fifth, regarding the communication system of claim 2, the examiner equates McEwan's receiver (elements 21-27 and 33 (Fig. 1)) with applicants' recited receiver. Applicants' receiver detects "data," as opposed to McEwan's "range". The receiver of applicants' claim 2 has been further defined as "a receiver that detects data from individual ones of said UWB pulses." McEwan '600, on the other hand, does not derive data from individual pulses. In fact, McEwan 600 (Fig. 3) receives an *overlapping* and *mixed* transmitted and received signals to measure range, and does not detect a single reflected signal or pulse. "Mixing occurs from the beginning of reception of a reflected signals at point 53 until the end of a transmitted signal at point 54. See, McEwan 600', *col. 6, lines 5-7.* Because McEwan does not detect "individual ones of said UWB pulses," as now claimed, the reference is not now anticipatory under Sec. 102. See also, §2131, MPEP.

Sixth, regarding the object detecting method of claim 3, applicants further characterized the recited "receiving" step. The receiving step of claim 3 is now recited to occur "after" the transmitting step.[4] In contrast, the receiver 22 (Fig.1) of McEwan '600

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[2] Support in the specification for the "wave filter" is shown by recital of the microwave filter at p. 21, line 2 and p. 16, line 30; and the bandpass filter described at p. 21, lines 25-26.

[3] The IEEE Standard Dictionary of Electrical and Electronic Terms defines "wave filter" as a transducer for separating waves on the basis of their frequency.

[4] This is similar to conventional radar operation but nevertheless distinguishable because conventional radar systems do not generate "low-level" UWB signal or filter such a low-level signal prior to transmission. Instead,

concurrently receives and mixes the transmitted and reflected signals. McEwan's range is then based on an amplitude differential derived from a relative phase shift between transmitted and received signals, which causes a partial cancellation of signals in the transmitted and reflected signals. Based on these differences in operation, McEwan '600 would not be an appropriate reference against claim 3, as amended.

Accordingly, applicants request withdrawal of the rejection previously applied against claims 2 and 3 under §102(e).

Claim Rejection under 35 U.S.C. §102(e) (Fullerton '927)

Claims 2 and 4 stand rejected under 35 USC §102(e) as being anticipated by Fullerton '927. As the examiner correctly notes, Fullerton '927 describes a UWB communication system to convey data. Generally, Fullerton '927 produces a series of monocycle pulses that are pulse-position modulated ("PPM") in at least two respects – first to encode data from an information source with a small amount of dither and second, to encode again the dithered signal by a pseudo-random noise code to produce a larger amount of dither. The second encoding has the effect of spreading the signal across of broader range of the RF spectrum in order to reduce the power spectrum density and associated co-band interference. In essence, Fullerton '927 is designed to intentionally radiate in all FCC-restricted bands.

Important to distinguishing over the rejected claim, Fullerton '927 states that his monocycle pulses are *not* gated sine waves. See Fullerton, col. 8, lines 28-30. In rejected claim 2, however, the recited "switched impulse generator [includes] one of an on-off switched oscillator, an oscillator having a time-gated dc bias that alternately biases the oscillator on and off, and an impulse-gated mixer that mixes an oscillator output," which produces waves that are wave-like or substantially sinusoidal. Thus, the switching or gating recited by claim 2 produces a UWB signal that differs from the monocycle pulses of Fullerton's pulse generator. The examiner, on the other hand, indicates that elements 1002, 1006, 1008, 1016, 1018, 1022, and 1028 make up the claimed impulse generator. While element 1028 comprises the monocycle pulse generator, the other mentioned elements merely provide a *time base* to produce a trigger signal for monocycle pulse generator 1028,

conventional radar systems radiate UWB signal immediately after production thereof. Signal processing or filtering of the high-power UWB radar signal (which is delivered directly to the antenna) does not typically occur.

which inherently produces a high peak voltage spike having one cycle. In relation to the amendatory claim recitals, the pulse generator 1028 is not characterized by (i) an *on-off switched oscillator*, (ii) an *oscillator having a time-gated dc bias that alternately biases the oscillator on and off*, or (iii) an *impulse-gated mixer that mixes an oscillator output*. In fact, Fullerton '927 does not at all show how a monocycle pulse is produced, or any circuitry for producing the monocycle pulse. Fullerton '927 only shows the trigger signal for the output stage 1028 the purports to generate a monocycle pulse. Thus, there is no disclosure in Fullerton to equate with elements of applicants' amended claims.

Also important in distinguishing rejected claims 2, Fullerton *integrates multiple monocycle pulses to recover each bit of the transmitted information* (see, col. 8, lines 16-17) and, Fullerton's impulse radio system uses *pulse trains, not single pulses, for communications* (see, col. 9, lines 1-2). In the disclosed embodiment, Fullerton '927 *integrates 200 or more pulses to yield [a] demodulated output*, e.g., a bit of information (see, col. 10, lines 26-27). In contrast, the receiver recited in claim 2 "detects data from *individual ones* of said UWB pulses."

Moreover, according to Fullerton '927, *amplitude and frequency/phase modulation are unsuitable for ... impulse communications* and *the only suitable choice is pulse position modulation* (see, col. 9, lines 29-32). Thus, Fullerton '927 would have no applicability to any of applicants' claims directed to amplitude, phase, or frequency modulation.

The examiner further contends that Fullerton '927, at col. 14, lines 17-21, teaches a filter. Notably, Fullerton (see, col. 10, lines 37-40) also stated that impulse radio systems require 1+ GHz of bandwidth, and therefore, "must" share the spectrum with other users -- thus dispelling any notion that band-limiting or out-of-band filtering to avoid restricted FCC bands would be workable. As such, it is applicants' position that providing "a filter that rejects FCC-restricted bands," as recited by amended claim 2, is not taught or suggested by Fullerton '927 which, at best, may teach use of a filter having a minimum bandwidth of 1.0 GHz in a pulse communication system. Nowhere in the Fullerton reference does he show implementation of a "filter." In fact, use of a filter in Fullerton '927 appears inconsistent with its teachings when read in light of the required bandwidth for pulse communication systems. Thus, it is applicants' view that Fullerton fails to teach or suggest an out-of-band rejection filter that inhibits use of FCC-restricted frequency bands.

Regarding claim 4, Fullerton '927 fails to teach the recited "waveform adapter" that dynamically controls the UWB signals on a real-time basis. As indicated earlier, Fullerton '927 posits that the only suitable control of UWB signals is pulse position modulation (PPM). Applicants have demonstrated otherwise, and by the arrangement of claim 4, recite a waveform adapter that, among other things, amplitude modulates or attenuates (e.g., on-off switching), frequency-modulates, phase-shift modulates, bandwidth modulates, or frequency hops the UWB signal. Fullerton '927 teaches none of these features and, as such, its applicability as a reference under §102 would also be inappropriate.

As indicated above, claims 2 and 4 are further distinguished in that the recited generator produces low-level UWB pulses or short bursts of RF energy, which are filtered or waveform adapted prior to transmission. Fullerton '927 fails to teach these features of the claims.

Newly amended claim 14, which depends from claim 4, is also distinguishable from Fullerton '927. In particular, claim 14 recites a series of discrete low-level ultra-wideband signals "comprised of short bursts of RF energy having a carrier frequency defined by cycle periodicity in respective ones of said short bursts." This differs from Fullerton '927 in at least two respects. First, Fullerton '927 only discloses *monocycle pulses* – not short bursts of RF energy, e.g., a few cycles of RF energy. Second, claim 14 recites short bursts of RF energy having a "carrier frequency" that is defined by the periodicity of the few cycles of RF energy in the short bursts. On the other hand, the monocycle pulse of Fullerton '927, by definition, would lack a carrier frequency since it comprises only a single pulse – having no periodicity "between" pulses. Thus, the invention of claim 14 also clearly defines over Fullerton '927.

Claim Rejection under 35 U.S.C. §102(b) (Ross '593)

The examiner rejected claims 1-3, 6-9, 14-16 and 21-24 under 35 USC §102(b) as being anticipated by Ross'593.

In rejecting claim 1, the examiner contends that elements 2, 3 of Ross' Fig. 9b show the claimed "switched impulse generator." Element 2, however, is a *time-base* oscillator – not an *impulse generator*, as the examiner suggests. Element 3 is a mixer. In combination, time-base oscillator 2 and mixer 3 generate a *timing* signal to trigger the UWB source, but do

not themselves produce a UWB signal. Specifically, Ross' oscillator 2 and divider-down counters 13, 33 provide a *time base* to drive mixer 3 and pulse generator (Marx generator) 9. Marx generator 9 delivers a "high-level" UWB pulse to antenna 5. Contrary to the examiner's assertions, the underlying *trigger* or *timing* circuitry, e.g., oscillator 2 and dividers 13 and 33, do not produce a signal that constitutes the UWB signal. Thus, Ross '593 fails to teach generating a "low-level" UWB pulse, as recited in claim 1.

Ross '593 also fails to teach a "filter" to filter a "low-level" UWB pulse. As explained above, no "low-level" UWB signals are produced in Ross '593, and thus, there can be no filtering of such "low level" UWB pulses. Even further, claim 1 recites a "wave" filter and an antenna responsive to such a filter. Since Ross '593 has no filter or wave filter, there can be no antenna responsive to a filter. In light of the above deficiencies, the rejection of claim 1 under §102(b) on the basis of Ross '593 should be withdrawn.

Regarding claim 2, the examiner asserts that elements 2,3 of Ross' Fig. 9b teach applicants' "switched impulse generator." In applicants' claim 2, however, the recited switched impulse generator produces (i) a low-level ultra-wideband signal and (ii) the low-level signal is characterized by a series of UWB pulses produced by an on-off switched oscillator, an oscillator having a time-gated dc bias that alternately biases the oscillator on and off, or an impulse-gated mixer that mixes an oscillator output. As earlier stated, Ross '593 does not generate "low-level" UWB pulses, so limitation (i) is missing in the reference. Ross '593 is also devoid of the type of oscillator and/or mixer characterized by claim 2. In applicants' claim 2, the oscillator and/or mixer produces the UWB signal. Element 2 and 3 of Ross' Fig. 9b, on the other hand, are merely time bases and do not produce a signal that constitutes the UWB signal. The radiated UWB signal is instead produced by Marx generator 9, which differs from the claimed switched oscillator. One of the applicants (Dr. Robert Fontana) described such a Marx generator circuit at page 3 of his declaration of non-obviousness (originally submitted in parent application SN 08/857,836, a copy of which was also filed 6/3/2002 in the present application). Thus, limitation (ii) is also missing in the Ross '593 reference.

The filter of claim 2 is also not found in Ross '593. Before the amendment, the recited filter of claim 2 responded to the switched impulse generator. Ross '593 has no such filter since his Marx generator 9 (Fig. 9b) supplied its UWB output directly to antenna 5.

Applicants have further limited claim 2 to a filter that passes a selected range of frequencies that lies from L-Band to the X-Band.[5] Clearly, Ross '593 (as well as all other cited and applied references including Fullerton '927) is devoid of such bandpass filter. Thus, Ross '593 fails to teach the filter recited in claim 2.

Regarding claim 3, the examiner contends that elements 2 and 3 of Ross '593 teach a method of generating switched impulse, low level UWB signals. As discussed above, generating a switched impulse UWB signal by impulse-switching an oscillator is not shown in Ross '593, which uses a Marx generator 9 to produce the UWB signal. Further, as explained above, Ross '593 does not show generating low-level UWB pulses. Thus, the impulse-switching step of claim 3 is not shown.

Likewise, Ross'593 does not show the "wave filtering" step. Ross '593 completely fails to disclose a filtering step after a UWB signal is produced. As earlier stated, Ross' UWB signal is supplied directly to antenna 5. No filter lies between the UWB source and the antenna. It follows that Ross '593 also fails to show "wave filtering." Accordingly, the filtering step is also missing in the applied Ross reference.

Regarding claims 6 and 21, distinctive features are set forth in the claims from which they depend. Claim 14 has been re-written to depend from claim 4, rejection of which was treated above.

The examiner also rejected claims 7, 15, and 22 as being unpatentable over Ross '593. Regarding claims 7 and 15, Ross '593 fails to show an "amplifier that amplifies said filtered *low-level* ultra-wideband signals" because it fails to show "low-level" UWB pulses. As indicated above, Ross '593 produces "high-level" UWB signals only, and those high level UWB signals are applied directly to antenna 5. Claim 22 has been amended slightly to provide amplifying "after generating said low-level ultra-wideband signal," which step is not shown by Ross '593 for reasons explained above.

The examiner's rejection of claims 8, 9, 16, 23, and 24 is believed to have stemmed from a mistaken interpretation of Ross '593. The descriptive text appearing a col. 7, lines 48-50 of Ross relates to a *time base* circuitry, not filtering a UWB signal. As indicated earlier, Ross' UWB signal is produced by Marx generator 9 and is then supplied directly to

[5] L-Band and X-Band ranges are disclosed in the specification at p. 11, lines 25-26; p. 27, lines 30-32; p. 30, line 15-19; p. 16, lines 24-32; p. 18, lines 22-25; and p. 21, lines 7-8.

antenna 5. There is no filter to bandpass or pulse shape a "UWB signal" (claim 8), to define a bandwidth of a radiated "UWB" signal or to reduce out-of-band emissions (claim 9), or a filter that substantially confines the generated UWB signal within a given passband (claims 16, 23, 24).

Accordingly, there is addition reason with withdraw the rejection.

Rejection of Claims 14 and 21 Under 35 U.S.C. §103(a)

Claim 14 and 21 were rejected under 35 USC §103(a) as being unpatentable over McEwan '600 in view of Ross '054 and Nicolson '422.

Claim 14 was amended to depend from claim 4, the rejection of which was treated above. Thus, the currently standing rejection is moot.

Claim 21, however, recites a tunnel diode in a receiver and depends from claim 3. It was rejected because, according to the examiner, Nicolson '422 and Ross '054 disclose use of a tunnel diode in a UWB receiver. Applicants, however, traverse the rejection against claim 21 for reasons advanced against the rejection of base claim 3.

Rejection of Claims 1, 3, 6-9, 14-16, and 21-24 Under 35 U.S.C. §103(a)

Claims 1, 3, 6-9, 14-16, and 21-24 were rejected under 35 USC §103(a) as being unpatentable over Fullerton '927 in view of Ross '593.

In reply, the combined teachings of Fullerton '927 and Ross '593 fail to render obvious the invention of claim 1 because they do not show, among other things, (i) a "switched impulse generator" to produce a *low-level* UWB energy pulse, (ii) a *wave filter* that filters low-level UWB energy pulse, or (iii) a receiver that detects a representation of the UWB energy pulse *after* radiating a transmitted energy pulse. As explained above, Fullerton'927 has an output stage 1028 (Fig. 10) that produces *monocycle* pulses. Prior to transmission, the *monocycle* pulses are applied directly to antenna 1030, and are not "low-level" within the meaning of applicants' claim 1. The "low-level" aspect of the UWB energy pulse of claim 1 advantageously permits waveform adapting, such as filtering, before applying the UWB energy pulse to a radiating antenna. Second, for reasons explained above, neither Fullerton '927 nor Ross '593 teaches or suggests receiving and demodulating/detecting a single UWB energy pulse, as recited in claim 1. Rather, Fullerton

'927 integrates 200 or more pulses to demodulate a single output since no information is carried in a single *monocycle* pulse. See Fullerton, col. 9, lines 4-5; and col. 10, lines 26-27. Third, neither Fullerton '927 nor Ross '593 teaches of suggests a receiver that receives a representation of a UWB energy pulse reflected from an object "after" the antenna completes radiating the transmitted signal. As explained above, instead of detecting a single pulse, Ross '593 uses "overlapping" transmitted and received signals to detect range.

Assuming Ross '593 indeed teaches radiating a UWB energy burst "after" completion of radiating the transmitted pulse, the examiner must show motivation to combine the respective teachings of Fullerton '927 and Ross '593. On one hand, Fullerton '927 discloses "monocycle" pulses in a data communication system in which data can only be detected by integrating 200 or more pulses while, on the other hand, Ross '593 discloses the use of "overlapping" transmit and receive UWB signal bursts. In essence, the examiner appears to say that the time-of-flight pulse traveling measurement used in a system according to applicants' claim 1 is obvious when neither Fullerton '927 nor Ross '593 shows detection of a single pulse (or inter-pulse travel time). In this situation, "motivation" is completely lacking. The teachings of the respective references are simply incompatible, and cannot be combined to support a rejection under §103(a).

If the rejection is sustained in the face of (i) clear incompatibility between the references and (ii) a failure of the combined teachings to show "all" elements of claim 1 as required by §2143.03, MPEP, the examiner is called upon, in accordance with the requirements of §2143.01, MPEP, to explain why a skilled artisan would indeed have been *motivated* to make any proposed modification of Fullerton '927 by what is allegedly taught by Ross '593 to construct a time-of-flight pulse measurement system (i.e., detecting a UWB energy pulse after completion of transmitting a UWB energy pulse).

Regarding the rejection of claim 3, it is clear that neither Fullerton '927 nor Ross '593 suggests (i) impulse-switching an *oscillator*, (ii) a *low-level* ultra-wideband signal, or (iii), receiving a reflected pulse *after* the transmitting step.

Regarding the rejection of claims 7, 15, and 22, Ross '593 does not teach interposing an amplifier between the low-level UWB signal and the antenna. The examiner's reference to element 7 (Fig. 9b) shows amplifying a trigger signal, not a UWB signal (which

is produced at the output of Marx generator 9). Thus, the rejection here appears to be based on an erroneous interpretation of the reference, and should be withdrawn.

Applicants' arguments against the rejection of claim 1 above also apply to claims 8-9, arguments advanced against the rejection of claim 2 apply to claim 16, and arguments advanced against the rejection of claim 3 apply to claims 23-24. In addition, applicants do not believe Fullerton '927 adequately discloses use of a filter since filtering is incompatible with spectrum smoothing provided Fullerton's pseudo-random noise encoding, as explained above.

Claim 14 has been re-written to depend from claim 4, the rejection of which was treated above.

Rejection of Claims 10-12, 17-19, and 25-27 Under 35 U.S.C. §103(a)

The examiner rejected claims 10-12, 17-19, and 25-27 as being unpatentable under 35 USC§103(a) over Fullerton '927 in view of Ross '593, as applied to claims 1, 3, and 6, further in view of Cronson '042. The examiner contends that Cronson '042 teaches a variable attenuator between the receiving antenna and a tunnel diode detector to minimize susceptibility to jamming. In comments directed to claims 12 and 27, the examiner referred to col. 3, lines 54-64 of Ross '593. That section of Ross '593, however, appears related to a "multipole transmitter" to reduce overall signal bandwidth – and not attenuation control at a receiver. Nevertheless, after considering the examiner's overall comments regarding these claims, it appears that further clarification was warranted.

Accordingly, applicants made respective amendments to claim groups 10-12, 17-19, and 25-27 to provide (i) adjustment in attenuation according to detected error, (ii) alternately applying a noise and a received information signal to a tunnel diode, and (iii) digitally controlling attenuation according to signals received during respective noise dwells and data dwells. Neither Cronson '042 nor any of the other cited references teaches or suggests these amendatory features.

As such, applicants request withdrawal of the rejection against claims 10-12, 17-19, and 25-27.

Serial No. 09/251,297
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Conclusion

Favorable reconsideration is respectfully requested. Applicants stand ready to assist the examiner in resolving any further issues that might arise in connection with this response.

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CLAIM AMENDMENTS
Serial No. 09/251,297
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1. (Currently Amended) A range measuring device comprising an ultra-wideband transmitter and receiver, said device comprising:

a switched impulse generator to generate a low-level waveform adaptive ultra-wideband signal comprised of a low-level UWB energy pulse,

a wave filter that filters said ~~low-level ultra-wideband signal~~ low-level UWB energy pulse to define a center frequency thereof and to produce a filtered low-level ~~ultra-wideband signal~~ UWB energy pulse having a given bandwidth and center-frequency;

an antenna responsive to said wave filter to radiate a transmitted signal representing said filtered low-level ~~ultra-wideband signal~~ UWB energy pulse; and

a receiver ~~for receiving said radiated ultra-wideband signal~~ that receives a representation of the transmitted signal reflected from an object after the antenna completes radiating the transmitted signal.

2. (Currently Amended) A communication system utilizing an ultra-wideband transmitter, said system comprising:

a switched impulse generator ~~including one of an impulse excited oscillator and a UWB impulse generator~~ to generate a low-level ultra-wideband signal characterized by a series of UWB pulses, said switched impulse generator including one of an on-off switched oscillator, an oscillator having a time-gated dc bias that alternately

biases the oscillator on and off, and an impulse-gated mixer that mixes an oscillator output;

a filter responsive to said switched impulse generator to filter said UWB pulses by substantially passing a range of frequencies from L-Band to X-Band;

an antenna responsive to said filter to radiate a representation of said ~~ultra-wideband signal~~ UWB pulses; and

a receiver ~~for receiving said radiated ultra-wideband signal~~ that detects data from individual ones of radiated UWB pulses.

3. (Currently Amended) A method for detecting an object utilizing ultra-wideband transmitting techniques, said method comprising:

~~generating a switched impulse,~~ impulse-switching an oscillator to generate a low-level ultra-wideband signal;

wave filtering said ~~switched impulse,~~ low-level ultra-wideband signal;

after said filtering step, transmitting a signal representing said ~~switched impulse,~~ low-level ultra-wideband signal; and

after said transmitting step, receiving from said object a reflected pulse of said ultra-wideband signal thereby to detect said object.

4. (Currently Amended) A waveform adaptive ultra-wideband transmitter comprising:

a signal generator to generate a series of discrete low-level ultra-wideband signals comprised of short bursts of RF energy having a ~~selectable~~ carrier frequency defined

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by cycle periodicity in respective ones of said short bursts;

a waveform adapter responsive to said low-level ultra-wideband signals and including at least one of a bandpass filter, a mixer, a pulse shaper, and an attenuator that controls one of frequency, pulse shape, bandwidth, phase, multi-level amplitude, and multi-level attenuation of said low-level ultra-wideband signals, said waveform adapter controlling said low-level ultra-wideband signals on a dynamic, real-time basis; and

an antenna responsive to said waveform adapter to radiate ultra-wideband signals.

5. (Canceled)

6. (Previously Presented) The range measuring device as recited in claim 1, wherein said receiver comprises at least one tunnel diode responsive to an echo pulse.

7. (Currently Amended) The range measuring device as recited in claim 1, further comprising an amplifier that amplifies said filtered low-level ultra-wideband signals.

8. (Previously Presented) The range measuring device of claim 7, wherein said filter comprises one of a band-pass filter and a pulse shaper.

9. (Currently Amended) The range measuring device of ~~claim 8~~, claim 1 wherein said filter defines a bandwidth of the signal radiated by the antenna to reduce out-of-band emissions radiated by said antenna.

10. (Currently Amended) The range measuring device of claim 1, wherein the receiver includes:

a variable attenuator coupled to a receiving antenna to adjust attenuation levels thereof based on a rate of error detection of said radiated ultra-wideband signal received at said receiver; and

a detector to detect an output of said variable attenuator.

11. (Currently Amended) The range measuring device of claim 10, wherein said detector comprises a tunnel diode and said variable attenuator adjusts said attenuation by alternately applying noise and received information signals to said tunnel diode.

12. (Currently Amended) The range measuring device of ~~claim 10~~ claim 11, further including a controller that digitally controls the variable attenuator according to signals received during respective noise dwells and data dwells to enable the detector to discriminate between noise and range measuring signals.

13. (Previously Presented) The range measuring device of claim 12, wherein said controller utilizes a bit error rate to discriminate between noise and range measuring signals.

14. (Currently Amended) The ~~communication system~~ waveform adaptive ultra wideband transmitter as recited in ~~claim 2~~ claim 4 wherein ~~said receiver comprises a tunnel diode to detect said radiated ultra-wideband signals~~ said discrete low-level ultra-wideband signals is comprised of

short bursts of RF energy having a carrier frequency defined by cycle periodicity in respective ones of said short bursts.

15. (Previously Presented) The communication system as recited in claim 2, further comprising an amplifier interposed between said filter and antenna to amplify said ultra-wideband signal.

16. (Currently Amended) The communication system as recited in claim 15, wherein said filter comprises one of a band-pass filter and a pulse shaper that substantially confines radiated emissions of said antenna within a given passband.

17. (Currently Amended) The communication system as recited in claim 2, wherein the receiver includes:

a variable attenuator coupled to a receiving antenna to adjust attenuation levels thereof based on a rate of error detection of said radiated ultra-wideband signal received at said receiver; and

a detector to detect an output of said variable attenuator.

18. (Currently Amended) The communication system as recited in claim 17, wherein said detector comprises a tunnel diode and said variable attenuator adjusts said attenuation by alternately applying noise and received information signals to said tunnel diode.

19. (Currently Amended) The communication system as recited in ~~claim 17~~ claim 18, further including a

controller that digitally controls the variable attenuator according to signals received during respective noise dwells and data dwells to enable the detector to discriminate between said noise and received information signals.

20. (Previously Presented) The communication system as recited in claim 19, wherein said controller utilizes a bit error rate to discriminate between noise and information signals.

21. (Previously Presented) The method of claim 3, further comprising the step of providing a tunnel diode to receive the reflected pulse.

22. (Currently Amended) The method of claim 3, further comprising, ~~prior to said transmitting step~~, after generating said low-level ultra-wideband signal, amplifying said ~~switched impulse,~~ low-level ultra-wideband signal.

23. (Currently Amended) The method of claim 22, wherein said filtering ~~comprise~~ comprises one of bandpass filtering and pulse shaping of said ~~switched impulse,~~ low-level ultra-wideband signal in order to substantially confine radiated emissions of said antenna within a given passband.

24. (Previously Presented) The method of claim 23, further comprising the step of defining a bandwidth of the signal radiated upon the object.

25. (Currently Amended) The method of claim 3, further comprising, in the receiving step:

variably attenuating the ~~echo~~ reflected pulse to adjust an attenuation level thereof according detected error in the reflected pulse received at said receiver~~;~~ and

detecting a signal produced by ~~an echo~~ the reflected pulse after said variably attenuating.

26. (Currently Amended) The method of claim 25, further including providing a tunnel diode to detect the reflected pulse and adjusting said variably attenuating by alternately applying noise and received information signals to said tunnel diode.

27. (Currently Amended) The method of ~~claim 25~~ claim 26, further including digitally controlling said variably attenuating of the reflected pulse according to signal received during respective noise dwells and data dwells to enable discrimination between noise and signals representing the ~~echo~~ reflected pulse.

28. (Previously Presented) The method of claim 27, including utilizing bit error rate to discriminate between noise and signals representing the reflected pulse.

29. (New) In a one-pulse, one-bit UWB transceiver system, a method of detecting transmitted information comprising:

generating a series of low-level UWB pulses of short duration,

modulating respective ones of said low-level UWB pulses according to respective bits of information,

bandpass filtering the low-level UWB pulses to reject out-of-band emissions,

radiating a filtered representation of said low-level UWB pulses, and

detecting at a receiver respective bits of information associated with distinctive ones of said UWB pulses. (McEwan detects "overlapping" bursts, Fullerton '927 integrate 200 pulses to form an information bit.)

30. (New) The method of claim 29, wherein said generating step includes generating a short burst of RF energy having a carrier frequency associated with said UWB pulses.

31. (New) The method of claim 30, wherein said short burst comprises a few cycles of RF energy that define a center frequency.

32. (New) The method of claim 31, wherein said bandpass filtering includes wave filtering said low-level UWB pulses.

33. (New) The method of claim 31, wherein said UWB pulses have pulse-to-pulse coherency.

34. (New) The method of claim 31, wherein said UWB pulses lack pulse-to-pulse coherency.

35. (New) The method of claim 31, wherein said generating step comprises impulse-driving an oscillator to produce said UWB pulses.

36. (New) The method of claim 31, wherein said generating step comprises impulse-driving a mixer which, in turn, gates an output of an oscillator to produce said UWB pulses.

37. (New) The method of claim 35, further comprising the step of impulse-driving the mixer with a low voltage with a short rise time thereby to enable switching at hundreds of megabits per second.

38. (New) The method of claim 31, wherein said generating step comprises time-gating a dc bias of an oscillator to produce said UWB pulses.

39. (New) The method of claim 31, wherein said modulating step comprises amplitude modulating said UWB pulses by on-off switching of the generating step.

40. (New) The method of claim 31, wherein said modulating step comprises multi-level amplitude modulating said UWB pulses produced by the generating step.

41. (New) The method of claim 31, wherein said modulating step comprises phase-shifting said UWB pulses.

42. (New) The method of claim 35, wherein said oscillator comprises a voltage-controlled oscillator and said modulating step comprises frequency-shifting the

voltage-controlled oscillator according to an information signal.

43. (New) The method of claim 42, further comprising the step of frequency-hopping the oscillator.

44. (New) The method of claim 31, wherein said detecting step including utilizing a tunnel diode to detect respective bits of information.

45. (New) The method of claim 44, further comprising utilizing a bit error rate to distinguish between error and information signals.

46. (New) The method of claim 31 further comprising, prior to said radiating step, amplifying the low-level UWB pulses.

47. (New) The method of claim 46, further comprising gating said amplifying in accordance with occurrence of said low-level UWB pulses in said generating step.

48. (New) The method of claim 31, wherein said short duration ranges between a sub-nanoseconds to a few nanoseconds.

49. (New) The method of claim 31, further including amplifying said low-level UWB pulse prior to said radiating step.

50. (New) A method of communicating data by transmitting and detecting an ultra wideband pulse, said method comprising:

generating a low-level UWB pulse that includes an energy burst having a few cycles of RF energy of a defined carrier frequency,

filtering the energy burst to reject out-of-band emissions,

radiating a filtered representation of said energy burst,

after said radiating step, detecting a bit of data associated with a filtered representation of said energy burst.

51. The method of claim 50, wherein said filtering step includes wave filtering said energy burst to reject out-of-band emissions.

52. The method of claim 50, wherein said generating step includes on-off switching of an oscillator to produce said energy burst.

53. The method of claim 50, wherein said generating step includes impulse-driving a mixer which, in turn, gates an output of an oscillator to produce said energy burst.

54. The method of claim 50, wherein said generating step includes time-gating a dc bias of an oscillator to produce said energy burst.

55. The method of claim 50, wherein said generating step includes impulse-driving a filter to produce said energy burst.

56. (New) A method of transmitting an ultra wideband pulse, said method comprising:

generating a low-level UWB pulse that includes an energy burst having a few cycles of RF energy at a defined carrier frequency,

wave filtering the energy burst to reject out-of-band emissions, and

radiating a filtered representation of said energy burst.

57. (New) The method of claim 56, further comprising amplifying said energy burst prior to said radiating.